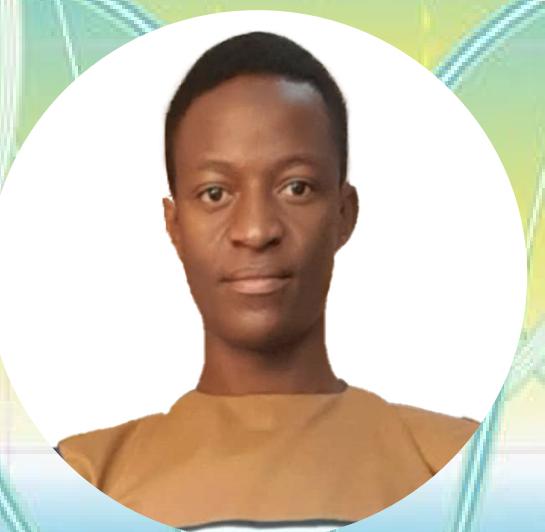


## ABOUT THE AUTHOR



Meet Agaba Ashraf a Teacher at Kololo Senior Secondary School but also a dynamic author with a Bachelor's Degree in Physics and Mathematics at Makerere University. Armed with a SESEMAT certificate in item creation for competence-based curriculum, Agaba brings a wealth of knowledge and passion for mathematics education to this scenario-based practice book. Dive into his punctiliously crafted items designed to engage and challenge learners, making mathematics an enjoyable journey of discovery. The major objective is Practice to Surplus"

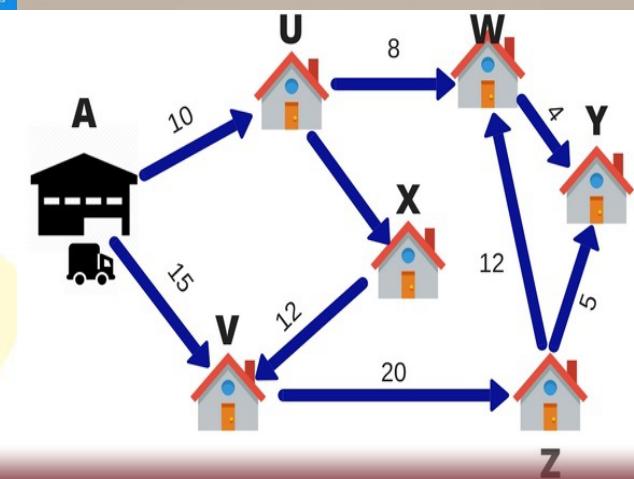
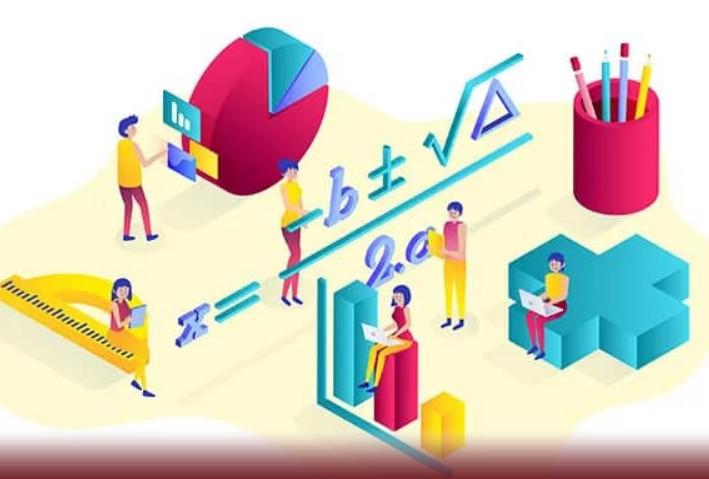
For any inquiries or additional assistance,  
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# QUEST CATALYST SCENARIO BASED MATHEMATICS

**Senior 1-4**



AGABA ASHRAF

**1<sup>st</sup> Edition**  
**Next Generation Learner**

2024

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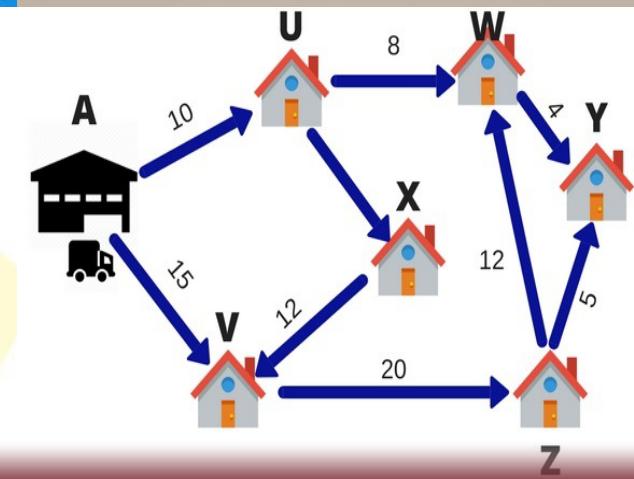
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QUEST CATALYST BY AGABA ASHRAF

1<sup>ST</sup> EDITION 2024

# QUEST CATALYST SCENARIO BASED MATHEMATICS

**Senior 1-4**



**1ST Edition | 2024**

**NEXT GENERATION LEARNER**

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# **MATHEMATICS**

# **NEW CURRICULUM**

**PAPER CODE: 456/1**

**MY NAME IS AGABA ASHRAF ALADIN**

# **SECTIONS AND TOPICS PER SECTION**

- **Mathematics as a subject has only one paper.**
- This **Exam** consists of two sections **A** and **B**.
- **Section A consists of two compulsory items.**
- **Section B consists two parts: Part 1 and Part 2**
- **Part 1 and Part 2 both consist of 2 items.**
- **One item is chosen from each part of section B.**

# TOPICS THAT ARE EXAMINED IN SECTION A

ITEM	Area of construct	Topics covered
<b>SECTION A: (compulsory)</b>		
ITEM 1	NUMBERS	<ul style="list-style-type: none"><li>✓ <b>Number bases</b></li><li>✓ <b>Working with integers</b></li><li>✓ <b>Fractions, percentages and decimals</b></li><li>✓ <b>Numerical concept 1 and 2</b></li><li>✓ <b>Ratios and proportions</b></li><li>✓ <b>Vectors and Translations</b></li></ul>
ITEM 2	PATTERNS AND ALGEBRA	<ul style="list-style-type: none"><li>✓ <b>Sequences and patterns</b></li><li>✓ <b>Equations of a straight-line</b></li><li>✓ <b>Algebra 1 and 2</b></li><li>✓ <b>Mapping and relations</b></li><li>✓ <b>Inequalities and regions</b></li><li>✓ <b>Quadratic Equations</b></li><li>✓ <b>Rectangular Cartesian plane</b></li><li>✓ <b>Simultaneous equations</b></li><li>✓ <b>Linear programming</b></li><li>✓ <b>Composite Functions</b></li><li>✓ <b>Loci</b></li></ul>

# TOPICS THAT ARE EXAMINED IN SECTION B

ITEM	Area of construct	Topics covered
<b>SECTION B: (choices)</b>		
<b>PART I (choose one question)</b>		
ITEM 3 and 4	DATA AND PROBABILITY	<ul style="list-style-type: none"><li>✓ <b>Graphs</b></li><li>✓ <b>Set theory</b></li><li>✓ <b>Data collection and display</b></li><li>✓ <b>Matrices</b></li><li>✓ <b>Probability</b></li></ul>
<b>PART II (choose one question)</b>		
ITEM 5 and 6	GEOMETRY AND MEASURES	<ul style="list-style-type: none"><li>✓ <b>Geometrical construction</b></li><li>✓ <b>Bearings</b></li><li>✓ <b>General and angle properties of geometric figures</b></li><li>✓ <b>Reflection</b></li><li>✓ <b>Business arithmetic</b></li><li>✓ <b>Time and tables</b></li><li>✓ <b>Similarities and enlargement</b></li><li>✓ <b>Circle</b></li><li>✓ <b>Rotation</b></li><li>✓ <b>Trigonometry 1 and 2</b></li><li>✓ <b>Three Dimensional Figures</b></li></ul>

# **FORMAT OF THE ITEMS**

- Situation/Scenario**
- Problem/challenge**
- Application**
- Task**

# **WHAT YOU ARE REQUIRED OF AS A CANDIDATE**

- **As a candidate, you must be able to;**
- **Patiently read and understand and the items.**  
**(Interpretation)**
- **have knowledge and content on the specific topics included in the item.**
- **You must be able to relate different topics at the same time while responding to a given task.**

# **Continuation.....**

- **Sometimes the questions in the tasks are hidden and you need to discover by yourself.**
- **Make sure you attempt an item after completely reading through it and the Tasks.**
- **Be able to start from any item in any section so that you gain confidence for the other items.**
- **Always prepare adequately before doing a math exam through practicing the short answer response items as they prepare you for the scenario based items.**

# SAMPLE ITEM 1

A man collected data that shows the weights of meat bought by customers at their home butchery on a certain day. He realized that on that day the butchery had received 40 customers and the weights of meat bought are as shown as below.

50	71	40	48	61	70	30	62
44	63	60	51	55	25	32	65
54	62	65	50	45	40	25	45
48	45	30	38	30	28	24	48
48	35	50	48	50	28	60	47

Task:

- Find the amount he should prepare such that 50% of the customers are considered the following day.
- Find the weight that is taken by most of the customers.

# UNEB SAMPLE ITEM

A day school holds a weekly assembly every Monday starting at 8:00 AM. The Head teacher has noticed a trend of learners arriving late for assembly. Since the school gates are opened at 7:30 AM, he decided to collect data from a sample of learners on their arrival times in minutes past 7:30 AM to make an informed decision about the assembly's start time. The collected data was as follows:

15, 18, 20, 22, 17, 25, 23, 28, 26, 21

30, 33, 35, 32, 36, 39, 42, 37, 41, 28

45, 48, 29, 31, 26, 27, 30, 33, 34, 31

28, 35, 40, 42, 37, 39, 36, 38, 29, 43

46, 47, 30, 32, 31, 45, 27, 44, 46, 49

52, 53, 55, 51, 50, 56, 57, 58, 59, 51

**CONT....**

**Task:**

- (a) Giving a reason, based on calculations using the data collected, suggest the time the assembly should always start.**
- (b) The deputy Head teacher advised the Head teacher to always start the assembly when at least 75% of the students are present. Based on the advice, determine the time the assembly should start.**

## SAMPLE ITEM 2

Immediately after COVID-19 in the month of May 2022, Uganda received **only 128** tourists that month that visited three game packs namely Murchison Falls (M), Kidepo Game Reserve (K) and Queen Elizabeth National Park (Q). **4** tourists remained in Kampala and visited some orphages. **6** visited **M only**. **10** visited **K only**. **8** visited **M and Q only**. Those who visited **K and Q only** were **30**. **10** tourists visited all the **three** game parks. Those who visited parks **M and K only** were four times those who visited park **Q only**.

**Task:**

- (a) Determine the number of tourists who visited Queen Elizabeth National Park.
- (b) State the number of tourists who visited each game park.
- (c) Find the number of tourists that visited;
  - (i) at least one game park.
  - (ii) at most two game parks.
- (d) Basing on mathematical calculations in (i) and (ii), state whether or not the government should improve on the Tourism sector.

# UNEB SAMPLE ITEM

The Ministry of Health in Uganda is conducting a survey about the existence of malaria in three districts: **A, B and C**. The ministry will then come up with control measures if the chance of a person testing positive having visited **at least one of the districts is above 50%**. The Ministry has intentionally selected a sample of people who visited the three districts and tested them for malaria. The test results have revealed that **50** people who visited district **A**, **60** people who visited **district B** and **40** people who visited **district C** tested positive for malaria. Additionally, **20** people who visited both **districts A and B**, **10** people who visited **districts A and C**, and **15** people who visited **districts B and C** tested positive for malaria. The Ministry has also discovered that **20** people who **only** visited **district C** tested positive for malaria and **40** people who visited the **three districts** tested negative for malaria.

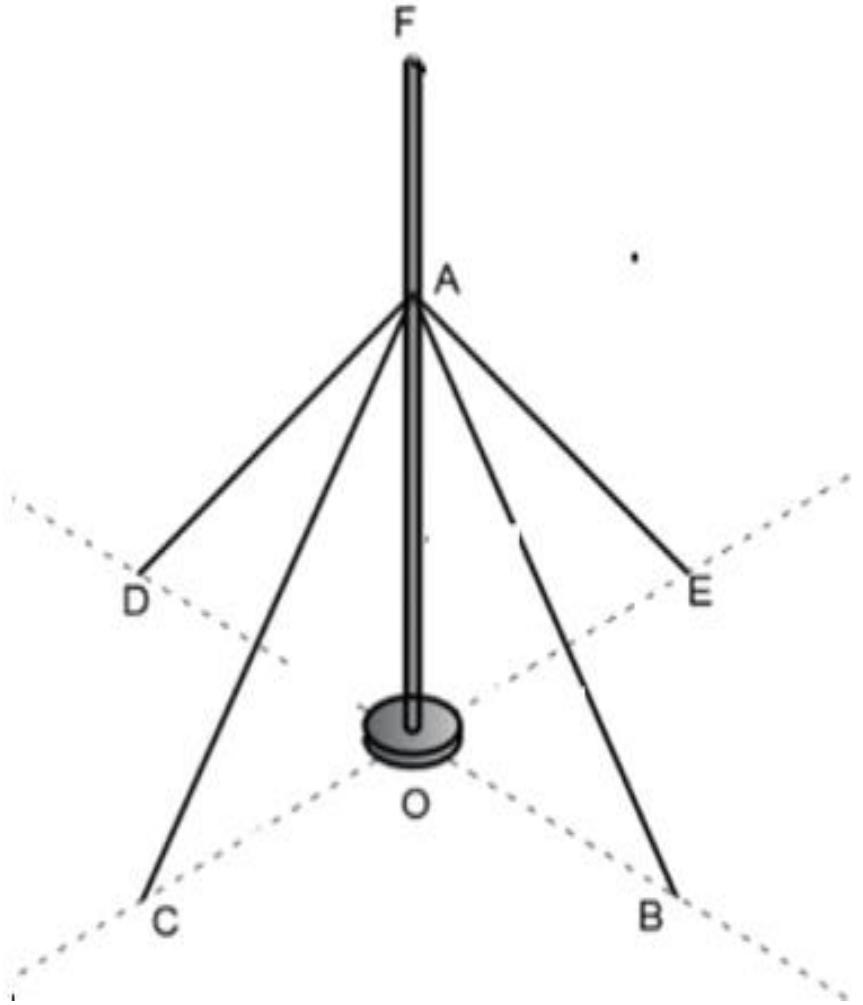
# CONT....

Task:

- a) Determine the number of people that were tested for malaria by the ministry of health.**
- b) Calculate the probability of a person testing positive having visited at least one of the three districts.**
- c) Advise the Ministry of health, with a reason based on calculation, whether to come up with control measures or not.**

## SAMPLE ITEM 3

A television transmitting aerial is supported by four strong cables as shown in the figure.



The points A, B, C and D where the cables are to be fixed on the ground forms a rectangle with sides 90m by 120m. The aerial stands on the ground at the centre of the rectangle and is 150m high. The point O, where the wires are fixed is 100m above the ground.

## **CONT.....**

**The points A, B, C and D where the cables are to be fixed on the ground forms a rectangle with sides 90m by 120m. The aerial stands on the ground at the centre of the rectangle and is 150m high. The point O, where the wires are fixed is 100m above the ground. Each metre length of the cable costs UGX. 10,000 and a 15% cash discount is offered on the total pay.**

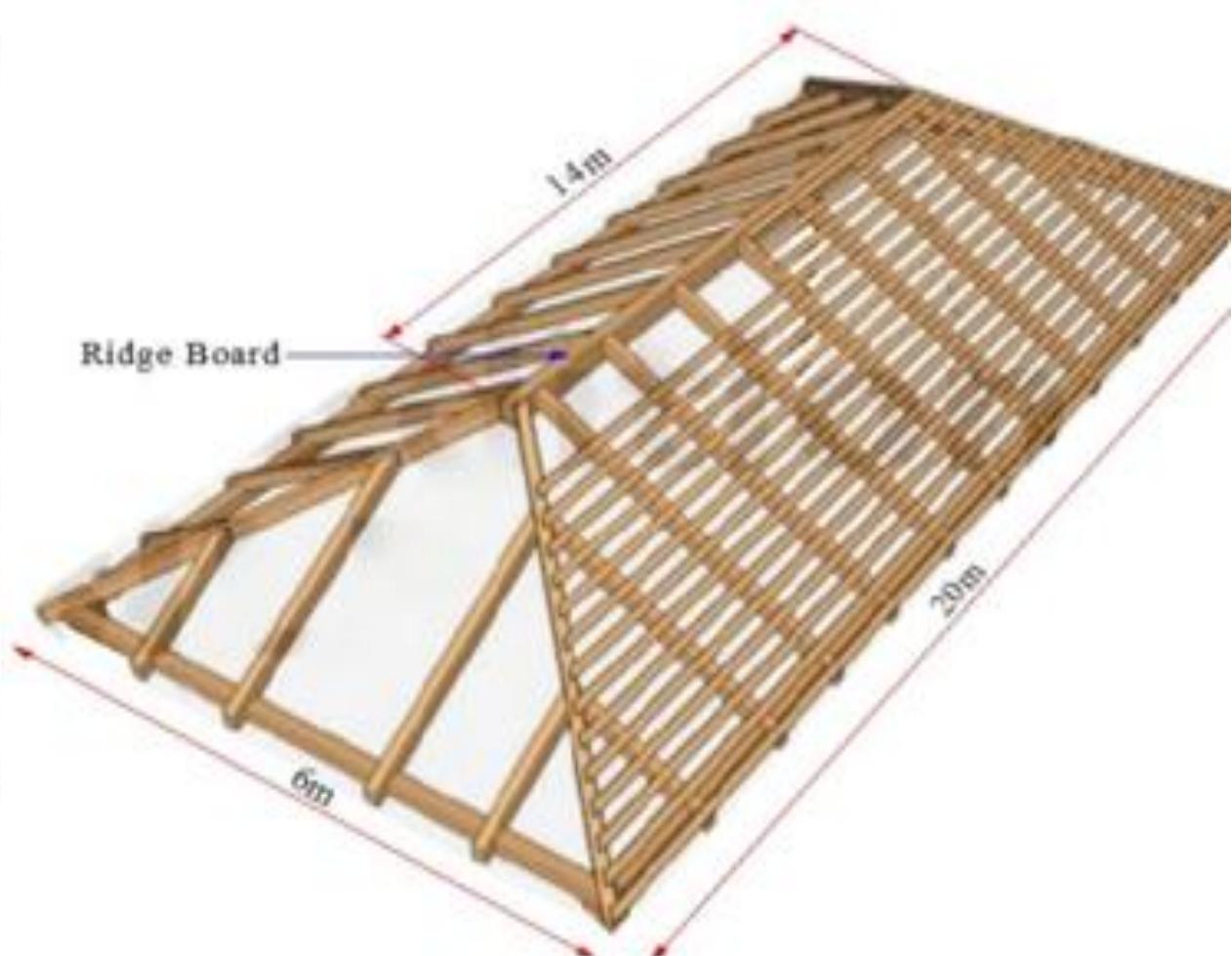
**Task:**

**If the aerial is to be firm;**

- a) How far from the ground can the cables be fixed.**
- b) The angle between the cables and the ground could be determined.**
- c) The length of the cables could be determined.**
- d) Find the amount that could be spent on cables.**

# UNEB SAMPLE ITEM

**Your neighbour has a building structure that is at a roofing stage with the roof frame installed as shown below:**



**The roof frame has a rectangular base with dimensions of 20 m by 6 m and the ridge board of 14 m centrally placed. The triangular faces are equilateral. She wants to use iron sheets that are available in two types; type A and type B. The iron sheet of type A costs Shs33,000 each and that of type B costs Shs42,000. Each iron sheet has a length of 10ft and usable width of 2.623 ft. (1ft = 0.3m) The hardware shop from which she wants to buy the iron sheets gives a discount of 6% on the total cost of every fifty (50) iron sheets of type A bought and a discount of 10% on the total cost of every seventy (70) iron sheets of type B bought.**

**She intends to borrow money from a bank to buy the iron sheets but she is not so sure of the amount to borrow.**

**CONT....**

**Task:**

**(a) Help your neighbour to estimate the amount of money to be borrowed from the bank for either type of iron sheets.**

**(b) Give your neighbour advice, with reason(s), on the type of iron sheets to buy.**

## SAMPLE ITEM 4

Your uncle has offered to drive you to your friend's birthday party. He normally drives his car at an average speed of **50 km/h**, so he requests you to get directions to the party reception and the time you are supposed to be there so that you decide on when you can leave home to reach on time. You were informed that the party will start at 2:00 PM and the directions are:

- From your home, take the **north eastern** direction and reach the supermarket that is **20 km** away.
- Then take the road that is **south** of the supermarket and it will take you **45 minutes** to reach the junction.
- From the junction, take the **southwestern** road and drive **25 km** to reach the party reception.

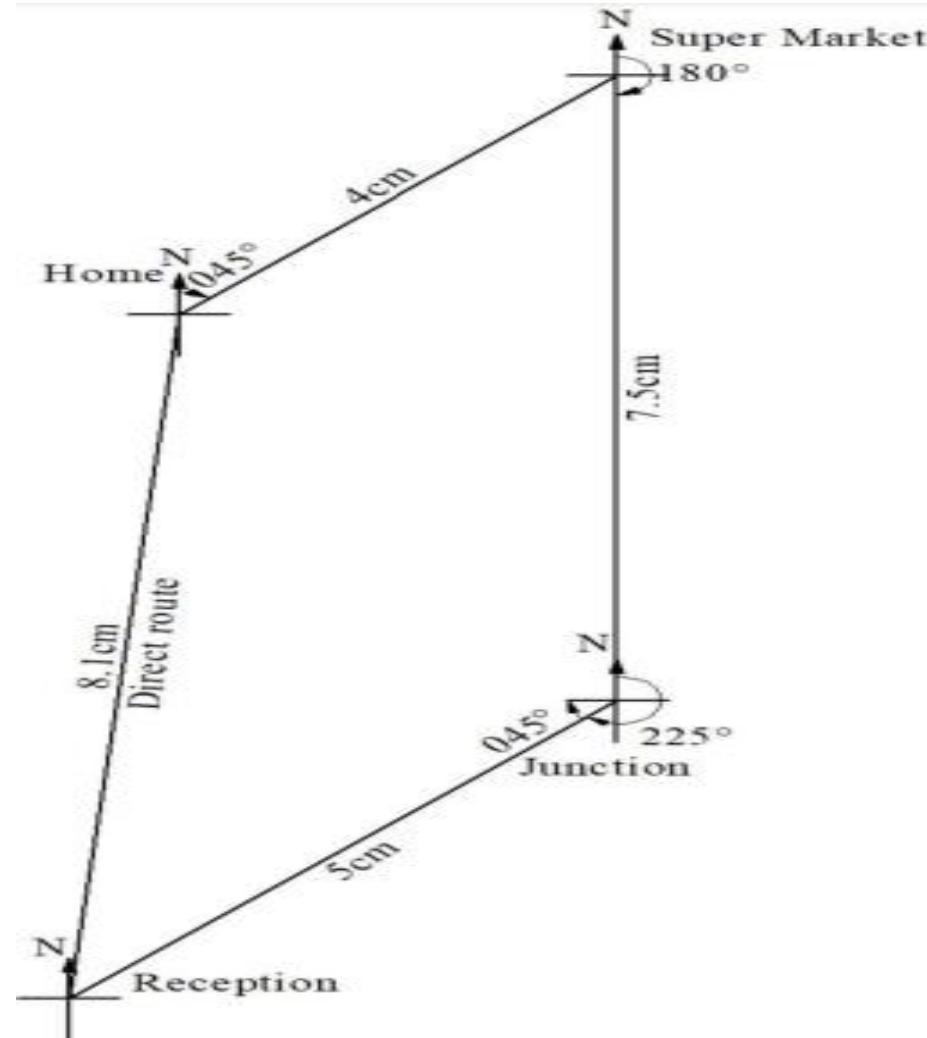
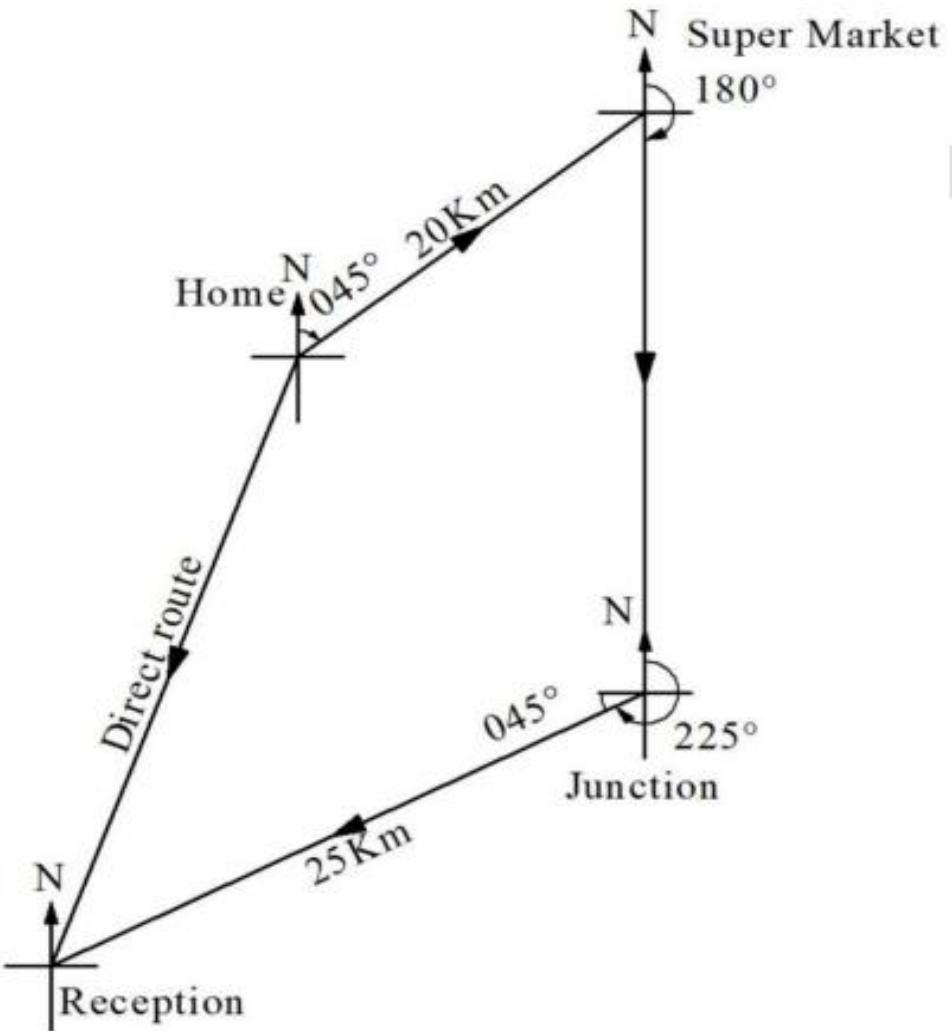
# **CONT....**

**On reaching the party reception using the given directions, your friend remembers that there is a **direct route** from your home to the reception that you could have used but does not know how long it is.**

**Task:**

- a)(i) Describe the direction of your home from the party reception.**
- (ii) How far is the party reception from your home using the direct route?**
- b) What time would you have to leave home for you to reach the party reception on time, if you used the direct route?**

# EXPECTED RESPONSES



## SAMPLE ITEM 5

Mr. Ssali works under the government and is a manager of a certain pharmaceutical industry. Of recent he comes up with an idea of owning an industry and this can happen through getting a loan. Before he does that, he makes a background data check on the way his money is taxed in order for him to establish the actual amount he can use per month to base on and get a **loan**. He gathers the following data from Stanbic bank; earns a **gross salary** of Shs.5,000,000 per month which includes some allowances as follows. Housing allowance shs.300,000 per month, marriage shs.500,000 per month, medical as  $\frac{1}{50}$  of the gross income and transport shs.10,000 per day. The rest of the income is subjected to an income tax which is calculated as follows:

**7.5% on the first shs.1,000,000**

**12.5% on the next shs.800,000**

**20% on the next shs.500,000**

**30% on the next shs.300,000**

**35% on the remainder.**

## **CONT.....**

- Mr. Ssali brings all this information to his personal accountant at the industry to verify all the information gathered.**
- The bank offers a loan at a simple interest rate of 39% per annum.**

### **Task:**

- As a personal accountant to Mr. Ssali, help him to determine;**
  - (a) his net income at the end of the month.**
  - (b) what percentage of his income goes to tax.**
  - (c) the amount he should borrow if his to pay a loan of 300 million in 10 years.**

## SAMPLE ITEM 6

A man wants to make a rectangular compartment at the back of his house, he wants it to be in contact with the existing brick wall at the exit door of his house. He aims at using this place to view the stars in the outer space using his movable telescope in the nights. He got the interest from his friend who had his plan of the layout as shown below.



If he wants to buy **60 m** of fencing material to cover three sides but there are two types of materials that cost **UGX. 6,000,000** with type A given at **10% discount** and type B given at a **20% discount**. This man's objective is to construct a simple compartment with an area of **450 m<sup>2</sup>** that can be enough for his telescope, his sit and even small movements.

# **CONT.....**

## **Task.**

- a)Basing on mathematical calculations, advise the man on how to choose the length and width of this compartment.**
- b)Find how much he is about to spend on each type of fencing material.**
- c)Using critical analysis, help him choose the fencing type material to use for his desired place.**

# SAMPLE ITEM 7

A local farmer in Budumba village wants to install a **sprinkler** system in their field to ensure even irrigation. The sprinkler is in such a way that **it distributes water evenly across all sides from the fixed distributing point**. The **square field** is of side **42 metres**. Seeking expertise, they have engaged you as an expert, known for their innovative agricultural solutions to design this irrigation setup.

## Tasks:

- (a) Help the farmer to design the **circular irrigation layout**, with the best position of the sprinkler such that a bigger part of the field is irrigated.
- (b) Determine the **total area** covered by the irrigation system.
- (c) Calculate the area of the part that is **not irrigated**.
- (d) If the cost charges are **3,000/= per square meter of irrigation area**. Calculate the **project cost for the farmer in Budumba**.

# SAMPLE ITEM 8

**Uganda National Road Authority (UNRA) is planning to construct a roundabout at mile twenty along Kampala Guru Road. The area identified should have a triangular flower garden with a base of 10 m and other two sides making an angle of  $60^\circ$  and  $45^\circ$  with the base. The vertices of the triangular garden should meet the roundabout at three different points. In order to construct a roundabout with the flower garden present and HK construction company is hired by UNRA.**

**Task:**

- a) As an architect who is part of the engineering department of HK, use relevant mathematical instruments and a suitable scale to come up with the layout of the actual plan.
- b) Determine the area that this round about covers and hence find the area that is left un flowered.
- c) Determine the distance around the round-about?
- d) If HK construction company charges 100,000 per meter constructed, find how much UNRA should prepare for HK company to complete this work.

## SAMPLE ITEM 9

Mugisha is a supplier of food to two schools X and Y. In the first week, he supplies; **20Kg of rice, 5 bunches of matoke and 36kg of beans to school X.** He also supplies; **22kg of rice, 8 bunches of matoke and 45kg of beans to school Y.** In the second week, he supplies; **25kg of rice, 8 bunches of matoke and 50kg of beans to school X.** He also supplies; **18kg of rice, 6 bunches of matoke and 25kg of beans to school Y.** If he supplies **at shs. 3,000 per kg of rice, shs. 30,000 a bunch of matoke and shs. 2200 per kg of beans.**

Task:

- a) Organise the information for the supplies of two weeks and use it to find the amount of money he receives for each school for his supplies in the two weeks.
- b) **Given that 10% of the total amount he receives is paid as tax and the remainder is paid for as school fees for his children Alice and Betty in the ratio of 3:5. Find how much:**

(i)he pays as tax

(ii) School fees he pays for Betty.

# SAMPLE ITEM 10

Mrs. Mukholi is going to bake chocolate cakes and plain cakes for sell. She wants **at least** two chocolate cakes and more plain cakes than chocolate cakes. Due to limited time and facilities, she cannot bake **more than** 10 cakes. The chocolate cakes are to be sold UGX. 2,500 each and plain cakes for UGX. 1,500 each. In order for her to make profits, UGX. 8,000 must be realized from the sales.

## Tasks:

As Mrs. Mukholi's child who has studied optimization, help her analyse this situation by;

- a) Developing mathematical statements that can be used to model this problem.
- b) Showing the feasible region when using of a graph.
- c) Finding how many cakes of each type should Mrs. Mukholi bake in order to maximize the profit.
- d) Determining the minimum number of cakes that she can bake and still make a profit.

# UNEB SAMPLE ITEM

You have friends who rear cows and goats. During the festive season, they want to sell **at most** 10 of their cows and **at least** 8 of their goats. They also want to ensure that the number of goats they sell are less than twice the number of cows. They also **do not want to** sell more than 20 animals all together. They wish to **maximise** sales by selling each goat at Shs200,000/= and each cow at Shs. 1.5 million but they do not know the number of goats and cows to sell to fulfil their wish.

## **Task:**

- a) write mathematical statements that show the relation between the cows and goats.
- b) Show the feasible region of the relation on the Cartesian plane.
- c) Help your friends to determine the maximum amount of money they will possibly make from the sale of cows and goats.

***FEEL AND APPRECIATE***

***THE RELEVANCE OF***

***MATHEMATICS***

***TR. AGABA ASHRAF ALADIN***

**2024**